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**Description****STORAGE MEDIUM FOR RECORDING SUBTITLE INFORMATION BASED ON TEXT CORRESPONDING TO AV DATA HAVING MULTIPLE PLAYBACK ROUTES, REPRODUCING APPARATUS AND METHOD THEREFOR****Technical Field**

- [1] The present invention relates to reproduction of storage medium recording moving picture data, and more particularly, to a storage medium recording subtitle information compatible with a subpicture method of a digital versatile disc (DVD) and a presentation method of a bluray disc, and based on text corresponding to moving picture data having a plurality of playback routes, and a reproducing apparatus and a reproducing method therefor.

**Background Art**

- [2] Among conventional text-based subtitle technologies there are Synchronized Accessible Media Interchange (SAMI) technology of Microsoft and Real-text technology of RealNetwork. These conventional text-based subtitle technologies are based on a video stream data file recorded on a storage medium or a video stream data file provided on a network, and have a structure in which a subtitle is output on the basis of synchronization time information with video data.
- [3] FIG. 1 is a reference diagram explaining the conventional text-based subtitle technology.
- [4] Referring to FIG. 1, there is a text-based subtitle file corresponding to video stream data, and on the basis of synchronization time information included in a subtitle file, for example <sync time 00:05>, the subtitle corresponding to video stream data is output.
- [5] That is, the conventional text-based subtitle information provides a subtitle file structure constructed assuming that continuous video data is reproduced.
- [6] FIG. 2 is a reference diagram explaining problems of the conventional text-based subtitle technology.
- [7] Referring to FIG. 2, with the conventional text-based subtitle file structure, there is a problem that when multiple story video having a plurality of playback routes is reproduced according to a user input, processing subtitles is impossible as shown in the figure. That is, only story route A can be reproduced, and story route B cannot be

reproduced.

- [8] In addition, there is another problem that the conventional text-based subtitle data is not compatible with subtitle data based on a bitmap image such as a subpicture method of a DVD or a presentation method of a bluray disc.

## **Disclosure of Invention**

### **Technical Problem**

- [9] There is a problem that when multiple story video having a plurality of playback routes is reproduced according to a user input, processing subtitles is impossible. In addition, there is another problem that the conventional text-based subtitle data is not compatible with subtitle data based on a bitmap image such as a subpicture method of a DVD or a presentation method of a bluray disc.

### **Technical Solution**

- [10] To solve the above problems, it is a first objective of the present invention to provide a storage medium recording subtitle information compatible with a subpicture method of a DVD and a presentation method of a bluray disc, and based on text corresponding to moving picture data having a plurality of playback routes, and a reproducing apparatus and a reproducing method therefor.
- [11] To accomplish the first objective of the present invention, there is provided a storage medium including: moving picture data having a plurality of playback routes; a plurality of subtitle data items corresponding to the playback routes and supporting random search for a subtitle; and mapping information linking the moving picture data and the subtitle data.
- [12] The subtitle data may include reference offset information indicating reference information to randomly search for a subtitle of a desired time at a high speed and reproduce the subtitle, text data containing subtitle contents that are converted into pixel data and output, style information specifying an output style of the pixel data, and control information to control the output of the converted pixel data.
- [13] By using information on a time elapsed from the reference offset information, the subtitle of a desired time may be randomly searched for at a high speed among the subtitle data.
- [14] The reference offset information may include a cell identifier (VOB\_ID and CELL\_ID) of a video object that is a recording unit of the storage medium, or a start position of a clip that is a recording unit of the storage medium.
- [15] The subtitle data may be described in the form of a markup language or a binary table.

- [16] In the subtitle data described in the form of a binary table, the style information, the control information, and the text information may have respective identifiers for distinguishing each other, and the control information may include indication information indicating the style information and the text information corresponding to the control information, and in order to reduce a search time by integer calculation when random search is performed, the size of each of the style information and the control information may be predetermined and sequentially recorded in a predetermined area.
- [17] The style information may include at least one among information items on the width and height of the pixel data area, a background color, a time when the pixel data is to be stored and deleted in a buffer memory, a starting point from which subtitle text is rendered, line spacing, output direction, bold type and Italic type of subtitle text, line break, color of subtitle text, and information on character code encoding.
- [18] The control information may include at least one among information items on an area on which the pixel data is to be output on the entire screen, a start point of subtitle text in the area, and a synchronization time indicating when the pixel data is to appear and disappear in synchronization with the moving picture data.
- [19] The the synchronization time information may be expressed as a lapse time from a reference cell (CELL) of a video object (VOBU) that is reference offset information of the moving picture data, or as a lapse time from a start position of a clip that is reference offset information of the moving picture data.
- [20] The synchronization time information may be expressed by using a present time stamp (PTS) time on the basis of a reference time for reproducing moving pictures.
- [21] The subtitle data or mapping information may further include at least one among font information describing the font of subtitle data to be displayed on the screen, information on a producer making the subtitle, packet identifier (PID) information of the subtitle data to distinguish from the moving picture data, and subtitle indication information by language of the subtitle data.
- [22] To accomplish the second objective of the present invention, there is provided a reproducing apparatus for reproducing a storage medium on which moving picture data is recorded, the apparatus including: a decoder decoding moving picture data having a plurality of playback routes; and a subtitle processor converting subtitle data corresponding to a predetermined route and selected by using a plurality of subtitle data items corresponding to the playback routes and supporting random search for a subtitle and mapping information linking the moving picture data and the subtitle data, into

pixel data, and synchronizing the converted pixel data with the moving picture data and outputting the pixel data.

- [23]       The subtitle processor may include: a text subtitle decoder identifying subtitle data corresponding to the moving picture data of a route to be reproduced by parsing the mapping information, and converting the identified subtitle data into pixel data by parsing the subtitle data; and a graphic controller controlling the pixel data by using the parsed mapping information and subtitle data such that the pixel data is synchronized with the moving picture data and output.
- [24]       In the subtitle data, by decoding the subtitle data, the text subtitle decoder may parse reference offset information indicating reference information to randomly search for a subtitle of a desired time at a high speed and reproduce the subtitle, text data containing subtitle contents that are converted into pixel data and output, style information specifying an output style of the pixel data, and control information to control the output of the converted pixel data, and based on the style information, convert the text data into pixel data, and by using the parsed control information, the graphic controller may control such that the converted pixel data is synchronized with the moving picture data and output.
- [25]       The text subtitle decoder may randomly search the subtitle data for the subtitle of a desired time at a high speed by using information on a time elapsed from the reference offset information.
- [26]       By using synchronization time information expressed as a lapse time from a reference cell (CELL) of a video object (VOBU) that is reference offset information of the moving picture data, or as a lapse time from a start position of a clip that is reference offset information of the moving picture data, the graphic controller may control the converted pixel data to be synchronized with the moving picture data and output.
- [27]       Also, to accomplish the second objective of the present invention, there is provided another method for reproducing data on a storage medium storing moving picture data having a plurality of playback routes, a plurality of subtitle data items corresponding to the playback routes and supporting random search for a subtitle, and mapping information linking the moving picture data and the subtitle data, the method including: reading the subtitle data corresponding to moving picture data of a route to be reproduced by parsing the mapping information; identifying subtitle data of a position to be reproduced according to continuous reproduction or reproduction by random search, by parsing the subtitle data, and converting the subtitle data into pixel data; and

synchronizing the converted pixel data with the moving picture data and outputting the pixel data.

### **Advantageous Effects**

[28] By using the mapping information and the subtitle data file structure according to the present invention, subtitle information compatible with a bitmap image method such as the subpicture method of a DVD and the presentation method of a bluray disc, and based on text corresponding to moving picture data having a plurality of playback routes can be provided.

[29] Furthermore, by including reference offset information in a subtitle data file, when random search or reproduction is performed, the time for searching for a subtitle can be reduced such that search efficiency can be enhanced.

### **Description of Drawings**

[30] FIG. 1 is a reference diagram explaining the conventional text-based subtitle technology;

[31] FIG. 2 is a reference diagram explaining problems of the conventional text-based subtitle technology;

[32] FIG. 3 is a reference diagram explaining text-based subtitle information corresponding to moving picture data having a plurality of playback routes according to a preferred embodiment of the present invention;

[33] FIGS. 4 through 10 are diagram explaining mapping information of moving picture data and subtitle data having a plurality of playback routes and the structure of subtitle data according to a preferred embodiment of the present invention;

[34] Also, FIGS. 11 through 17 are diagrams explaining an implementation example of mapping information and subtitle data implemented on a DVD disc as a preferred embodiment of the present invention;

[35] Meanwhile, FIGS. 18 through 24 are diagrams explaining an implementation example of mapping information and subtitle data implemented on a bluray disc as another preferred embodiment of the present invention;

[36] More specifically, FIG. 4 is a diagram explaining mapping information of moving picture data and subtitle data having a plurality of playback routes according to a preferred embodiment of the present invention;

[37] FIG. 5 is a diagram explaining subtitle indication information by language corresponding to moving picture data having a plurality of playback routes according to a preferred embodiment of the present invention;

[38] FIG. 6 is a diagram explaining the structure of subtitle data according to a



preferred embodiment of the present invention;

[39] FIG. 7 is a diagram explaining a usage example of each field of subtitle data having the data structure of FIG. 6;

[40] FIG. 8 is a diagram explaining the structure of a reproducing apparatus according to a preferred embodiment of the present invention;

[41] FIG. 9 is a diagram explaining the structure of a subtitle processor of FIG. 8 in detail;

[42] FIG. 10 is a flowchart of the steps performed by a reproducing method for providing subtitle information based on text corresponding to moving picture data having a plurality of playback routes according to a preferred embodiment of the present invention;

[43] FIG. 11 is a diagram explaining the data structure of mapping information shown in FIG. 4 implemented on a DVD disc as an embodiment of the present invention;

[44] FIG. 12 is a diagram showing an example of mapping information shown in FIG. 11 implemented by using a markup language on a DVD disc as an embodiment of the present invention;

[45] FIG. 13 is a diagram showing an example of the mapping information described in the form of a table implemented on a DVD disc as an embodiment of the present invention;

[46] FIG. 14 is a diagram explaining the structure of subtitle data shown in FIG. 6 implemented on a DVD disc as an embodiment of the present invention;

[47] FIGS. 15A and 15B are diagrams showing an example of subtitle data implemented on a DVD disc displayed on a screen as a preferred embodiment of the present invention;

[48] FIG. 16 is a diagram showing an example of subtitle data implemented by a markup language on a DVD disc as an embodiment of the present invention;

[49] FIG. 17 is a diagram showing an example of subtitle data implemented in the form of a binary table on a DVD disc as an embodiment of the present invention;

[50] FIG. 18 is a diagram explaining the data structure of mapping information shown in FIG. 4 implemented on a bluray disc as another embodiment of the present invention;

[51] FIG. 19 is a diagram showing an example of mapping information shown in FIG. 18 implemented by using a markup language on a bluray disc as another embodiment of the present invention;

[52] FIG. 20 is a diagram showing an example of the mapping information described in

the form of a table implemented on a bluray disc as another embodiment of the present invention;

[53] FIG. 21 is a diagram explaining the structure of subtitle data shown in FIG. 6 implemented on a bluray disc as another embodiment of the present invention;

[54] FIGS. 22A and 22B are diagrams showing an example of subtitle data implemented on a bluray disc displayed on a screen as another preferred embodiment of the present invention;

[55] FIG. 23 is a diagram showing an example of subtitle data implemented by a markup language on a bluray disc as another embodiment of the present invention; and

[56] FIG. 24 is a diagram showing an example of subtitle data implemented in the form of a binary table on a bluray disc as another embodiment of the present invention.

### **Best Mode**

[57] FIGS. 3 through 10 are diagram explaining mapping information of moving picture data and subtitle data having a plurality of playback routes and the structure of subtitle data according to a preferred embodiment of the present invention.

[58] Also, FIGS. 11 through 17 are diagrams explaining an implementation example of mapping information and subtitle data implemented on a DVD disc as a preferred embodiment (1) of the present invention.

[59] Meanwhile, FIGS. 18 through 24 are diagrams explaining an implementation example of mapping information and subtitle data implemented on a bluray disc as another preferred embodiment (2) of the present invention.

[60] First, according to a preferred embodiment of the present invention, a storage medium recording subtitle information based on text corresponding to moving picture data having a plurality of playback routes, and a reproducing apparatus and a reproducing method therefor will now be explained.

[61] The storage medium according to a preferred embodiment of the present invention has a structure including moving picture data having a plurality of playback routes for multiple story playback, a plurality of subtitle data items corresponding to the plurality of playback routes and supporting random search for a subtitle, and mapping information linking the moving picture data and subtitle data described above.

[62] FIG. 3 is a reference diagram explaining text-based subtitle information corresponding to moving picture data having a plurality of playback routes according to a preferred embodiment of the present invention.

[63] Referring to FIG. 3, in order to select and reproduce story A route or story B route for multiple story playback, video data A and video data B are linked to video data C.

[64] FIG. 4 is a diagram explaining mapping information of moving picture data and subtitle data having a plurality of playback routes according to a preferred embodiment of the present invention.

[65] Referring to FIG. 4, shown is mapping information for linking moving picture data having a plurality of playback routes and a plurality of subtitle data corresponding to the moving picture data in order to support multiple story playback. That is, mapping information on the left hand side includes indication information for subtitle data items (A through C) corresponding to each video data items (A through C). According to this, whichever a user selects between playback A route and playback B route, video data and the corresponding subtitle can be output continuously.

[66] FIG. 5 is a diagram explaining subtitle indication information by language corresponding to moving picture data having a plurality of playback routes according to a preferred embodiment of the present invention.

[67] Referring to FIG. 5, subtitle indication information by language according to the present invention indicates related mapping information for individual subtitle languages supported.

[68] Also, the mapping information indicates a plurality of subtitle data items corresponding to a plurality of playback routes, respectively, as described above with reference to FIG. 4.

[69] For example, as shown in FIG. 5, if in a storage medium providing English, Korean, and Japanese subtitles, Korean subtitle is selected by a user selection, or as a set default, by the pointer of related mapping indication information, subtitle/video mapping information Y supporting Korean subtitle is linked. Also, a plurality of subtitle data A through C written in the corresponding language Y, that is, in Korean, are linked to A through C video data items having a plurality of playback routes included in subtitle/video mapping information Y, respectively. Accordingly, multiple language subtitles are supported and at the same time, multiple story playback of moving picture data having a plurality of playback routes is enabled.

[70] FIG. 6 is a diagram explaining the structure of subtitle data according to a preferred embodiment of the present invention.

[71] Referring to FIG. 6, shown is the structure of a plurality of subtitle data linked by related subtitle indication information included in the subtitle/video mapping information described above with reference to FIG. 4.

[72] The subtitle data according to a preferred embodiment of the present invention includes header information, reference offset information, time information and/or text



information.

- [73] First, header information is information on the entire subtitle data and may include position information of a subtitle to be displayed on a screen, and international standard record code (hereinafter referred to as ISRC) as information on a producer or a support language code.
- [74] Reference offset information is reference information for randomly searching for a subtitle of a desired time at a high speed and reproducing the subtitle. A cell identifier (VOB\_ID and CELL\_ID) of a video object (VOBU) used as a recording unit of a DVD storage medium, or the starting point of a clip used as a recording unit of a bluray disc storage medium can be used as reference offset information.
- [75] Synchronization time information synchronizing a subtitle with video data can be expressed as a lapse time from a starting point of a reference cell of a VOB or a clip that is reference offset information of moving picture data. In particular, synchronization time information can be expressed by using a presentation time stamp (hereinafter referred to as PTS) time on the basis of a reference time for reproducing moving pictures.
- [76] Text information indicates text data containing subtitle contents to be converted into pixel data to present a bitmap image of the text subtitle and output.
- [77] Also, the text information may include style information specifying the output style of pixel data and control information for controlling the output of the converted pixel data. The style information and control information will be explained later.
- [78] FIG. 7 is a diagram explaining a usage example of each field of subtitle data having the data structure of FIG. 6.
- [79] Referring to FIG. 7, subtitle data according to a preferred embodiment of the present invention includes position information of a subtitle to be displayed on a screen, a language code and/or ISRC information as header information. Also, the subtitle data includes a plurality of synchronization time information items synchronizing the subtitle with video data, and a plurality of text information items of a subtitle to be used as subtitle contents. Furthermore, the subtitle data includes reference offset information for random search for a subtitle, and each reference offset information item indicates an immediate next reference offset information item. Accordingly, by using reference offset information, a subtitle can be searched for at a high speed, and synchronization time information for synchronizing a subtitle with video data can also be expressed by a lapse time from reference offset information.
- [80] The storage medium according to the present invention as described above

includes moving picture data having a plurality of playback routes, a plurality of subtitle data corresponding to the plurality of playback routes, and subtitle/video mapping information for multiple story playback. Also, subtitle data includes reference offset information for high speed random search. In addition, in order to support multiple language subtitles, subtitle indication information by language can be further included. The subtitle/video mapping information, subtitle data, and subtitle indication information by language above described can be recorded as files separate from moving picture data, and can be recorded on an identical storage medium on which moving picture data is recorded, or can be recorded separately in a server or the like on the Internet.

[81] Based on the data structure of the storage medium described above, the structure of a reproducing apparatus according to the present invention will now be explained.

[82] FIG. 8 is a diagram explaining the structure of a reproducing apparatus according to a preferred embodiment of the present invention.

[83] Referring to FIG. 8, the reproducing apparatus according to the present invention includes a reading unit 810, a decoder 830, a subtitle processor 840, and a blender 850. Also, the reproducing apparatus may further include a buffer unit 820 temporarily storing data for buffering data.

[84] The reading unit 810 reads each data item having the data structure described above from a storage medium or from the Internet 800, and depending on the type of each data item, store the data in a corresponding buffer unit 820. That is, AV stream data is stored in a moving picture data buffer 822, a plurality of subtitle data items corresponding to a plurality of playback routes (Refer to FIG. 6) are stored in a subtitle data buffer 824, and subtitle/video mapping information (Refer to FIG. 4) and subtitle indication information by language (Refer to FIG. 5) are stored in the corresponding buffer 826. Furthermore, font information of a subtitle is stored in a default font buffer 828. Meanwhile, a resident font buffer 842 storing a resident font read from a storage medium or from the Internet and residing on a memory can also be disposed

[85] The decoder 830 decodes video stream data stored in the moving picture data buffer 822 and transmits moving pictures to be output to the blender 850.

[86] The subtitle processor 840 generates a graphic image of a subtitle to be overlaid on moving pictures to be output, and controls the output of a subtitle to be synchronized with video data.

[87] That is, the subtitle processor 840 receives subtitle data from the subtitle data buffer 824, receives mapping information from the subtitle/video mapping information

buffer 826, and identifies subtitle data corresponding to moving picture data corresponding to a selected language and a selected story route. By decoding the subtitle data, the subtitle processor 840 converts (or renders) the subtitle data into pixel data for a bitmap image and transmits the pixel data to the blender 850. At this time, by using style information included in the subtitle data, the output style of the subtitle can be controlled, and by using control information included in the subtitle data, an output time can be controlled to be synchronized with video data.

- [88] Font information stored in the default font buffer 828 and/or the resident font buffer 842 can be used. A detailed structure of the subtitle processor 840 will be explained later.
- [89] Rendering in the present invention indicates all required activities related to converting subtitle text data into graphic data to express the text data on a display apparatus. That is, it indicates all processes for finding a font matching a character code of each character in text data, from download font data read from an information storage medium, or from the resident font data, converting into a graphic, and outputting on a screen.
- [90] The blender 850 receives decoded video data from the decoder 830, receives converted pixel data from the subtitle processor 840, overlays the pixel data of a subtitle on an image based on the video data, and outputs to the display apparatus 860.
- [91] FIG. 9 is a diagram explaining the structure of the subtitle processor 840 of FIG. 8 in detail.
- [92] Referring to FIG. 9, the subtitle processor 840 according to the present invention includes a text subtitle decoder 902 and a graphic controller 904.
- [93] The text subtitle decoder 902 receives subtitle data, subtitle/video mapping information, other language information, and font information from the buffers 824 and 826 described above, parses subtitle/video mapping information, identifies subtitle data corresponding to moving picture data of a route to be reproduced, parses the identified subtitle data, and converts the subtitle data into pixel data for a bitmap image graphic.
- [94] By using the subtitle/video mapping information and subtitle data parsed by the text subtitle decoder 902, the graphic controller 904 controls an output time and position of the converted pixel data such that the converted pixel data is output synchronized with moving picture data.
- [95] More specifically, the text subtitle decoder 902 decodes subtitle data, and parses reference offset information indicating reference information for randomly searching

at a high speed for a subtitle of a desired time among subtitle data, and reproducing the subtitle, text data including subtitle contents to be converted into pixel data and then output, style information specifying an output style of pixel data and control information for controlling the output of converted pixel data. Also, based on the parsed style information, text data is converted into pixel data.

[96] Also, the graphic controller 904 controls based on the parsed control information such that the converted pixel data is synchronized with moving picture data and output. An output time point or an output position can be included in control information.

[97] A reproducing method according to the present invention based on the data structure recorded on a storage medium according to a preferred embodiment of the present invention and the structure of the reproducing apparatus described above will now be explained.

[98] FIG. 10 is a flowchart of the steps performed by a reproducing method for providing subtitle information based on text corresponding to moving picture data having a plurality of playback routes according to a preferred embodiment of the present invention.

[99] Referring to FIG. 10, in order to support multiple language subtitles and multiple story playback, first, a subtitle indication information item corresponding to a language selected by a user or set as a default in a reproducing apparatus is read among subtitle indication information by language (Refer to FIG. 5) in step 1002. By parsing subtitle indication information corresponding to the selected language, linked subtitle/video mapping information is read in step 1004. By parsing the read subtitle/video mapping information, subtitle data linked to video data of a route to be reproduced is read in step 1006. Based on style information and text information included in the read subtitle data, pixel data for a bitmap image graphic is generated in step 1008. Finally, by controlling a time and position for outputting a subtitle based on control information included in the subtitle data, the generated pixel data is output in step 1010.

[100] Accordingly, the subtitle of the language selected by the user or as a default setting can be reproduced along the story playback route. At this time, subtitle indication information by language, subtitle/video mapping information, or subtitle data can be recorded on an identical storage medium on which moving picture data is recorded, or can be disposed on the Internet separately, and in the latter case, the address on the Internet can be stored on a storage medium.

[101] Meanwhile, referring to FIGS. 11 through 17, an implementation example of mapping information and subtitle data implemented on a DVD disc, as an embodiment

(1) of the present invention will now be explained.

[102] On a DVD disc, a video manager (VMG) in which header information on the entire video title is recorded, and a plurality of video title sets (VTS) are stored. A video object set (hereinafter referred to as VOBS) is linked to the VMG. Meanwhile, to the VTS, a VOBS for displaying a menu screen and a plurality of video objects (VOBs) are linked.

[103] Meanwhile, a VOB is formed with a plurality of Cells, and each cell is formed with a plurality of video object units (VOBUs).

[104] In information for navigation of video data, VOBV\_VOB\_IDN information and VOBV\_C\_IDN information are recorded such that a video object to which a current VOBV unit belongs and identifier of a Cell (VOB\_ID and CELL\_ID) can be known. Also, C\_ELTM information is recorded such that a relative reproduction time from the first video frame of a Cell to which a current VOBV belongs, to the first video frame of the current VOBV can be known.

[105] Mapping information and the structure of subtitle data according to the present invention based on the DVD disc structure described above will now be explained.

[106] FIG. 11 is a diagram explaining the data structure of mapping information shown in FIG. 4 implemented on a DVD disc as an embodiment (1) of the present invention.

[107] Referring to FIG. 11, a storage medium according to the present invention includes a video object VOB that is a recording unit of moving picture data of a DVD and indication information on subtitle data linked to the VOB.

[108] Subtitle/video mapping information on the left hand side includes indication information indicating a VOBS linked to at least one or more subtitles. Also, information indicating linking relations between VOBSs is also included.

[109] Besides, at least one is included among language information on which language is used to generate subtitle data, screen display title information of a subtitle, information on at least one or more fonts, ISRC code information of a producer who made subtitles, color table information to be used for a background color and foreground color of a subtitle character, and stream number information of a text subtitle to distinguish it from subtitle stream data of a subpicture method in AV stream data that is moving picture data.

[110] The stream number information of a text subtitle may include, for example, a number set to SPRM (2), which is a system register of a reproducing apparatus.

[111] FIG. 12 is a diagram showing an example of mapping information shown in FIG. 11 implemented by using a markup language on a DVD disc as an embodiment (1) of



the present invention.

- [112] Referring to FIG. 12, it can be seen that video object 1 in <vmg\_vobs> tag is linked to a subtitle data file 1202, file://english\_vmgm.text, video object 1 in <vtms\_vobs> tag is linked to a subtitle data file 1204, file://english\_vtms.text, and video object 1-9 in <vtstt\_vobs> tag is linked to a subtitle data file 1206, file://english\_tt1vob1.text. Besides, language information, title information, font information, ISRC information, stream IDs, and color table information are included.
- [113] The example here uses the XML method but other encoding methods can also be used for presentation. That is, in the present invention, which data should be used is of importance, and the method for expressing data can be performed by selecting to use a markup language, or a binary table, or another method. Data that can be included in subtitle/video mapping information can be arranged as follows.
- [114] FIG. 13 is a diagram showing an example of the mapping information described in the form of a table implemented on a DVD disc as an embodiment (1) of the present invention.
- [115] Referring to FIG. 13, position information 1302, 1304, and 1306 of subtitle data corresponding to a video object is included. Besides, language information, title information, font information, ISRC information, color table information, and stream ID information can be included.
- [116] Meanwhile, in a DVD, subtitle data displayed overlapping a video image is encoded in the same manner as 2-dimensional graphic data is encoded. That is, in the case of a DVD, a separate encoding method to support multiple languages is not employed, and each subtitle data is converted into pixel data for a bitmap image graphic, and then the pixel data is processed by one encoding method and recorded. Graphic data for a subtitle is referred to as a subpicture. A subpicture is formed with a subpicture unit (SPU) corresponding to one sheet of graphic data. As output control information to output pixel data, output starting time information, color information of pixel data, information on contrast with video data, and information on an output time and a finish time are included.
- [117] FIG. 14 is a diagram explaining the structure of subtitle data shown in FIG. 6 implemented on a DVD disc as an embodiment (1) of the present invention.
- [118] Referring to FIG. 14, subtitle data according to an embodiment (1) of the present invention includes header information, reference offset information, time information and/or text information.
- [119] Header information and text information are the same as explained with reference

to FIG. 6.

- [120] However, the reference offset information is reference information to randomly search for a subtitle of a desired time at a high speed and reproduce the subtitle, and uses the cell identifier (VOB\_IDN and CELL\_IDN) of the video object (VOB) described above, which is used as a recording unit of a DVD storage medium. Also, as synchronization time information, a lapse time from a starting time point of a reference cell is used. In particular, synchronization time information can be expressed by using a presentation time stamp (PTS) time on the basis of a reference time to reproduce moving pictures. Besides, style information specifying the output style of pixel data and control information for controlling output of converted pixel data can be included. The style information and control information will be explained later.
- [121] FIGS. 15A and 15B are diagrams showing an example of subtitle data implemented on a DVD disc displayed on a screen as a preferred embodiment (1) of the present invention.
- [122] In a DVD, pixel data is losslessly coded and information on a position at which a subpicture of a subtitle is displayed (SP display area) in an area to display the entire screen, and information for controlling an output start time and finish time, an output direction, and line spacing are included. In a DVD, subpicture data for subtitle data of a maximum of 32 different languages can be multiplexed together with moving picture data and recorded. Each language is distinguished by a stream id provided by the MPEG system coding method, and a sub stream id defined by the DVD. Accordingly, if a user selects one language, the corresponding subpicture unit (SPU) is extracted by taking only subpictures (SP\_PCK) having the stream id and sub stream id corresponding to the language, and then, by decoding the subpicture unit (SPU), subtitle data is extracted and according to output control information, the output is controlled.
- [123] Referring to FIGS. 15A and 15B, the method for displaying a text-based subtitle according to the present invention constructed to have compatibility with the subpicture method of a DVD disc is shown.
- [124] The subtitle data described with reference to FIG. 14 is parsed by the subtitle processor 840 of FIG. 8 and converted into pixel data having an output image as shown in FIGS. 15A and 15B, and transferred to the blender 850. Accordingly, the reproducing apparatus according to the present invention can receive the pixel data for a bitmap image according to the present invention as the conventional bitmap-based subpicture data, synchronize it with video data and output on the screen. As a result, without modifying the structure of the conventional decoder 830, a subtitle can be

processed to be compatible with the conventional subpicture method.

- [125]      The text-based subtitle data according to the present invention has the following structure in order to be compatible with the subpicture method of a DVD as described above.
- [126]      FIG. 16 is a diagram showing an example of subtitle data implemented by a markup language on a DVD disc as an embodiment (1) of the present invention.
- [127]      Referring to FIG. 16, when text-based subtitle data is randomly searched for, in order to search for the data at a high speed, a storage medium according to the present invention uses a video object number (VOB\_IDN), a cell number (CELL\_IDN), and a lapse time from a cell (time) as reference offset information (1600). Also, information indicating next reference offset information (next) is included.
- [128]      Also, text information including the contents of a subtitle and style information indicating an output style are included (1602 and 1606).
- [129]      Furthermore, control information for outputting pixel data obtained by converting a text subtitle after synchronization with video data is also included (1604 and 1608).
- [130]      Preferably, in order to generate the pixel data as shown in FIGS. 15A and 15B based on the subtitle data of FIG. 16, style information as the following is included in the text-based subtitle data according to the present invention.
- [131]      It is desirable that in style information included in subtitle data according to the present invention, information on the width and height of a pixel data area to indicate the size of the pixel data is recorded. Preferably, also included are information on the color of a background screen of pixel data rendering subtitle text, time information on when pixel data is to be generated and deleted in the buffer memory of pixel data, information on a starting point from which the first line of subtitle text begins, information on line spacing when a plurality of lines of subtitle text are output, information indicating whether the output direction of text is from left to right or from right to left, or in the vertical or horizontal direction, information on the shape, such as size, bold and Italic, of subtitle text, line break information, and character code change information.
- [132]      The subtitle processor 830 parses style information in subtitle data having the information described above and controls the output style of subtitle text.
- [133]      Meanwhile, preferably, in order to control so that pixel data converted by applying the style information described above is synchronized with video data and output on the screen, the following control information is included.
- [134]      Preferably, in the control information included in subtitle data according to the

present invention, position information ((Xs, Ys), (Xe, Ye)) specifying an area to be actually output on the screen among pixel data, information on a starting point in a pixel data area corresponding to the first starting point of a text subpicture display area (Text SP Display Area) shown in FIG. 15A, and time information on when the bitmap image of pixel data appears and disappears on the screen are recorded.

[135] In FIG. 16, shown is subtitle data information 1600 which when vob\_id is any one of 1 to 5 and cell\_id is 1, a subtitle is made to be output by calculating a synchronization time (sync time) on the basis of vob\_idn=1-5 and cell\_idn=1. That is, by using a lapse time (time) from the video object number (VOB\_IDN) and cell number (CELL\_IDN) that are reference offset information, when text-based subtitle data is randomly searched for, retrieval can be quickly performed.

[136] Also, <text> tag indicates style information and subtitle text information and <pixmap> tag indicates control information for outputting pixel data.

[137] As 'begin' or 'end' information of <pixmap> tag or <text> tag, a lapse time from a Cell or PTS time information calculated from the standard time clock (STC) described above is appropriate. Also, 'start' information of <text> tag indicates address information of a starting point from which text is rendered, and 'start' information of <pixmap> tag indicates information on an address from which pixel data is to be output.

[138] In addition, as an example of control information, synchronization time information for outputting subtitle data synchronized with video data can be expressed as a lapse time from a reference cell of a video object, and in particular, screen output time (Presentation Time Stamp, PTS) information based on a STC used by a reproducing apparatus to reproduce video data can be used.

[139] The example shown in FIG. 16 uses the XML method, but this is just an example and the contents of subtitle data including style information and control information, reference offset information and header information, described above can be expressed by other encoding methods. A case where subtitle data is expressed by a binary table method, not by the XML method will now be explained.

[140] FIG. 17 is a diagram showing an example of subtitle data implemented in the form of a binary table on a DVD disc as an embodiment (1) of the present invention.

[141] Referring to FIG. 17, unlike in FIG. 16, an example of subtitle implemented in the form of a binary table shape is shown. Subtitle data according to the present invention includes style information 1710, control information 1720, and text information 1730, and includes header information indicating starting positions of these information items. In pixmap #1 1712 as an example of control information, information indicating

the position of style information (style = '1') and the position of text information (text\_offset = '1') is included. According to this, corresponding subtitle text information can be found, and by applying the indicated style information, pixel data can be generated and based on the control information, the output of the generated pixel data is controlled.

[142] In particular, by implementing each of the style information and control information to have a predetermined size and to be stored sequentially in a predetermined area, search time for random search and reproduction can be reduced compared to the conventional XML structure such as SAMI technology and Real-text technology, such that efficiency of search is enhanced.

[143] Meanwhile, referring to FIGS. 18 through 24, an implementation example of mapping information and subtitle data implemented on a bluray disc as another embodiment (2) of the present invention will now be explained.

[144] In a bluray disc, an AV stream in which moving picture data is recorded is divided into clip units and recorded. In addition, according to a presentation method similar to the subpicture method of a DVD, subtitle data is converted into pixel data based on a bitmap and processed. The structure of subtitle data and mapping information according to the present invention based on the bluray disc structure will now be explained.

[145] FIG. 18 is a diagram explaining the data structure of mapping information shown in FIG. 4 implemented on a bluray disc as another embodiment (2) of the present invention.

[146] Referring to FIG. 18, a storage medium according to the present invention includes a clip that is a recording unit of moving picture data of a bluray disc and indication information indicating subtitle data 1802 linked to the clip.

[147] Subtitle/video mapping information on the left hand side includes indication information indicating a clip linked to at least one or more subtitles. Besides, at least one among language information on which language is used for subtitle data, screen display title information of a subtitle, information on at least one or more fonts, ISRC code information of a producer making the subtitle, color table information to be used for a background color and a foreground color of a subtitle character, and information on a packet identifier (hereinafter referred to as PID) number of a text subtitle to distinguish from subtitle stream data in the subpicture method in AV stream data that is moving picture data is included. PID number information of a text subtitle can include, for example, a number set to PSR (2), which is a Player Status Register.



- [148] FIG. 19 is a diagram showing an example of mapping information shown in FIG. 18 implemented by using a markup language on a bluray disc as another embodiment (2) of the present invention.
- [149] Referring to FIG. 19, it can be seen that subtitle clip file 0001 in <blu-ray-video> tag is linked to subtitle data file 1902, 'english\_0001.text'. Besides, language information, title information, font information, ISRC information, information on the PID number of a subtitle, and color table information are included.
- [150] The example here uses the XML method but other encoding methods can also be used for presentation. That is, in the present invention, which data should be used is of importance, and the method for expressing data can be performed by selecting to use a markup language, or a binary table, or another method. Data that can be included in subtitle/video mapping information can be arranged as follows.
- [151] FIG. 20 is a diagram showing an example of the mapping information described in the form of a table implemented on a bluray disc as another embodiment (2) of the present invention.
- [152] Referring to FIG. 20, position information of subtitle data corresponding to a video clip is included (2002). Besides, language information, title information, font information, ISRC information, color table information, and stream ID information can be included.
- [153] FIG. 21 is a diagram explaining the structure of subtitle data shown in FIG. 6 implemented on a bluray disc as another embodiment (2) of the present invention.
- [154] Referring to FIG. 21, subtitle data according to another embodiment (2) of the present invention includes header information, reference offset information, time information and/or text information.
- [155] Header information and text information are the same as explained with reference to FIG. 6.
- [156] However, the reference offset information is reference information to randomly search for a subtitle of a desired time at a high speed and reproduce the subtitle, and uses reproduction time information (presentation time stamp, PTS) of the start position of a clip described above, which is used as a recording unit of a bluray disc storage medium. Also, as synchronization time information, a relative time to a starting time point of reproduction of a clip is used. In particular, synchronization time information can be expressed by using a presentation time stamp (PTS) time on the basis of a reference time to reproduce moving pictures.
- [157] Besides, style information specifying the output style of pixel data and control in-

formation for controlling output of converted pixel data can be included. The style information and control information will be explained later.

- [158] FIGS. 22A and 22B are diagrams showing an example of subtitle data implemented on a bluray disc displayed on a screen as another preferred embodiment (2) of the present invention.
- [159] Referring to FIGS. 22A and 22B, the subtitle data described with reference to FIG. 21 is parsed by the subtitle processor 840 of FIG. 8 and converted into pixel data having an output image as shown in FIGS. 22A and 22B, and transferred to the blender 850. Accordingly, the reproducing apparatus according to the present invention can receive the pixel data for a bitmap image according to the present invention as the conventional bitmap-based presentation data of a bluray disc, synchronize it with video data and output on the screen. As a result, without modifying the structure of the conventional decoder 830, a subtitle can be processed to be compatible with the conventional presentation method of a bluray disc.
- [160] The text-based subtitle data according to the present invention has the following structure in order to be compatible with the presentation method of a bluray disc as described above.
- [161] FIG. 23 is a diagram showing an example of subtitle data implemented by a markup language on a bluray disc as another embodiment (2) of the present invention.
- [162] Referring to FIG. 23, when text-based subtitle data is randomly searched for, in order to search for the data at a high speed, a storage medium according to the present invention uses the reproduction start time point (sync-offset value) of a video clip. Also, information indicating next reference offset information (next) is included.
- [163] Also, text information including the contents of a subtitle and style information indicating an output style are included (2302 and 2306).
- [164] Furthermore, control information for outputting pixel data obtained by converting a text subtitle after synchronization with video data is also included (2304 and 2308).
- [165] Preferably, in order to generate the pixel data as shown in FIGS. 22A and 22B based on the subtitle data of FIG. 23, style information described with reference to FIG. 16 is included in the text-based subtitle data according to the present invention. The subtitle processor 830 parses style information in subtitle data having the information described above and controls the output style of subtitle text.
- [166] Meanwhile, preferably, in order to control so that pixel data converted by applying the style information described above is synchronized with video data and output on the screen, the following control information is included.

- [167] Preferably, in the control information included in subtitle data according to the present invention, position information (cropping) specifying an area to be actually output on the screen among pixel data, information on a starting point (pixmap position) in a pixel data area corresponding to the first starting point of a text subpicture display area (Text SP Display Area) shown in FIG. 22A, and time information (composition begin end) on when the bitmap image of pixel data appears and disappears on the screen are recorded.
- [168] In FIG. 23, subtitle data information for outputting a subtitle in which a reproduction start time of a clip is '0' is shown. That is, by using the reproduction start time information of a clip that is reference offset information, when text-based subtitle data is randomly searched for, retrieval can be quickly performed.
- [169] Also, <text> tag indicates style information and subtitle text information and <composition> tag indicates control information for outputting pixel data.
- [170] As 'begin' or 'end' information of <composition> tag or <text> tag, a lapse time from a reproduction start time of a clip or PTS time information calculated from the standard time clock (STC) described above is appropriate. Also, 'start' information of <text> tag indicates address information of a starting point from which text is rendered and 'position' information of <pixmap> tag indicates information on an address from which pixel data is to be output.
- [171] In addition, as an example of control information, synchronization time information for outputting subtitle data synchronized with video data can be expressed as a relative time on the basis of the reproduction start time point of a video clip, and in particular, screen output time (Presentation Time Stamp, PTS) information based on a STC used by a reproducing apparatus to reproduce video data can be used.
- [172] The example shown in FIG. 23 uses the XML method, but this is just an example and the contents of subtitle data including style information and control information, reference offset information and header information, described above can be expressed by other encoding methods. A case where subtitle data is expressed by a binary table method, not by the XML method will now be explained.
- [173] FIG. 24 is a diagram showing an example of subtitle data implemented in the form of a binary table on a bluray disc as another embodiment (2) of the present invention.
- [174] Referring to FIG. 24, unlike in FIG. 23, an example of subtitle implemented in the form of a binary table shape is shown. Subtitle data according to the present invention includes style information 2410, control information 2420, and text information 2430, and includes header information indicating starting positions of these information

items. The detailed structure is explained above with reference to FIG. 17.

[175] In particular, by implementing each of the style information and control information to have a predetermined size and to be stored sequentially in a predetermined area, search time for random search and reproduction can be reduced compared to the conventional XML structure such as SAMI technology and Real-text technology, such that efficiency of search is enhanced.

[176] Optimum embodiments have been explained above and are shown. However, the present invention is not limited to the preferred embodiment described above, and it is apparent that variations and modifications by those skilled in the art can be effected within the spirit and scope of the present invention defined in the appended claims.

[177] The present invention can also be embodied as computer readable codes on a computer readable recording medium. The computer readable recording medium is any data storage device that can store data which can be thereafter read by a computer system. Examples of the computer readable recording medium include read-only memory (ROM), random-access memory (RAM), CD-ROMs, magnetic tapes, floppy disks, optical data storage devices, and carrier waves (such as data transmission through the Internet). The computer readable recording medium can also be distributed over network coupled computer systems so that the computer readable code is stored and executed in a distributed fashion.

#### **Industrial Applicability**

[178] As described above, by using the mapping information and the subtitle data file structure according to the present invention, subtitle information compatible with a bitmap image method such as the subpicture method of a DVD and the presentation method of a bluray disc, and based on text corresponding to moving picture data having a plurality of playback routes can be provided.

[179] Furthermore, by including reference offset information in a subtitle data file, when random search or reproduction is performed, the time for searching for a subtitle can be reduced such that search efficiency can be enhanced.